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Patent
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): **Thyssen et al.**

Application Serial No.: **09/841,764**

Filed: **April 24, 2001**

Title: **Silence Description Coding for Multi-Rate Speech Codecs**

Group Art Unit: **2654**

Examiner: **Nolan, D.**

APPEAL BRIEF

BOX AF
Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

INTRODUCTION

This is an Appeal from the Examiner's Final Rejection of claims 21-44 and 46-53. The Final Rejection issued on Jun 14, 2002 (Paper No. 10). The Notice of Appeal was received in the U.S. Patent and Trademark Office on July 30, 2002.

REAL PARTY IN INTEREST

The real party in interest is Conexant Systems, Inc.

RELATED APPEALS AND INTERFERENCES

There are no related Appeals or Interferences.

STATUS OF CLAIMS

Claims 21-44 and 46-53 are pending. Claims 21-44 and 46-53 have been finally rejected. This Appeal is directed to the rejection of claims 21-44 and 46-53. Claims 21-44 and 46-53 appear in an appendix to this Appeal Brief.

STATUS OF AMENDMENTS

Amendments to claims 21, 34, 38 and 46 were submitted on July 23, 2002 in response to the Final Rejection dated June 14, 2002 (Paper No. 10). An Advisory Action issued on August 12, 2002 indicated that the amendments to claims 21, 34, 38 and 46 submitted on July 23, 2002 were not entered.

SUMMARY OF INVENTION

A. Brief Description

The present invention relates to a communication system, a communication device, a speech codec, and a method for coding a speech signal having varying characteristics, wherein one of a plurality of speech coding modes is selectively applied to a speech signal segment of the speech signal independent of the speech coding mode applied to other speech signal segments. The selection of one of the plurality of speech coding modes is independent of past, present, and future coding schemes that are employed to various portions of the speech signal.

A source speech signal (element 520 in Fig. 5 corresponding to element 320 in Fig. 3 and element 420 in Fig. 4) has varying characteristics, at least one of which can be a substantially speech-like characteristic. The source speech signal is processed by a speech codec (element 510

in Fig. 5 and element 410 in Fig. 4). A voice activity detection circuit (element 540 in Fig. 5) of the speech codec identifies an existence of a substantially speech-like signal in the source speech signal. A source coding mode selection circuit (element 560 in Fig. 5) selects one of a plurality of coding modes (elements 562 to 568 in Fig. 5) to encode the source speech signal based on the detection of the substantially speech-like signal in the source speech signal as detected by the voice activity detection circuit. The speech codec may also detect other perceptual characteristics of the source speech signal using a processing circuit (element 550 in Fig. 5) to assist in the coding of the source speech signal. The source speech signal is then encoded by an encoder circuit (element 570 in Fig. 5) using the coding mode selected by the source coding mode selection circuit.

In one embodiment of the present invention, the speech codec performs silence description coding of the source speech signal. In this embodiment, the voice activity detection circuit detects the absence of a substantially-speech like signal in the source speech signal. The source coding mode selection circuit then selects one of the plurality of coding modes to encode the source speech signal based on the detection of the absence of a substantially speech-like signal in the source speech signal. In some embodiments, the coding scheme selected to encode the source speech signal comprises one of a plurality of data transmission rates from a multi-rate speech codec (page 9, lines 9-12 of the specification). In certain embodiments, the selected data transmission rate is the lowest data transmission rate within the multi-rate speech codec (page 10, lines 1-2 of the specification). The source speech signal is then encoded by the encoder circuit using the coding mode selected by the source coding mode selection circuit.

The silence description coding is performed independent of past, present, and future coding schemes that are employed to various portions of the speech signal. Thus, the silence

description coding that is applied to a particular portion (or segment) of the speech signal having a substantially non-voice-like characteristic is not coupled to the silence description coding that is applied to other portions (or segments) of the speech signal (page 9, lines 18-23 of the specification).

Independent apparatus claims 21, 38 and 46 set forth the basic communication device, communication system, and speech codec, respectively, for performing speech coding in accordance with the present invention. Independent claim 34 sets forth the basic method for employing speech coding in accordance with an embodiment of the present invention.

B. Claim 21 and its dependent claims

The communication device of claim 21 includes a voice activity detection circuit that is capable of identifying a substantially speech-like characteristic of a segment of the speech signal, and a processing circuit communicatively coupled to the voice activity detection circuit, the processing circuit being capable of selectively applying one of a plurality of coding modes to the segment of the speech signal, wherein the plurality of coding modes comprises a plurality of speech coding modes and a silence description coding mode, wherein the processing circuit selects the silence description coding mode upon the identification of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment.

Dependent claims 22 to 33 specify various embodiments of the communication device of independent claim 21. Thus, claims 22, 23, 24 25, 26, 31 and 32 specify that the communication device may be a wireless communication device, a telephone, a cellular telephone, a handheld wireless communication device, a network communication device, a data processor, and a network interface device, respectively. Claims 27 and 28 specify that the network

communication device is capable of communicating via a network and of transmitting an encoding speech signal via a network, respectively. Claim 29 specifies that the communication device is capable of communicating via a wireless network. Claim 30 further specifies that the wireless network of claim 29 includes a communication cell. Claim 33 specifies that the processing circuit selects a discontinuous transmission mode after the silence description coding mode.

C. Claim 38 and its dependent claims

The communication system of claim 38 includes a coder, a decoder, and a communication network selectively interconnecting the coder and the decoder, wherein the coder comprises a voice activity detector, a processor coupled with the voice activity detector, and a transmitter coupled with the processor, wherein the voice activity detector receives first and second segments of a speech signal and identifies a substantially speech-like characteristic of the first segment and an absence of a substantially speech-like characteristic of the second segment of the speech signal, wherein the processor selectively applies one of a plurality of coding modes to the first and second segments, the plurality of coding modes comprises a plurality of speech coding modes and a silence coding mode, wherein the processor applies the silence description coding mode to the second segment of the speech signal independent of the speech coding mode applied to the first segment of the speech signal immediately before the second segment.

Dependent claims 39 to 44 specify various embodiments of the communication systems of independent claim 38. Thus, claim 39 specifies that the decoder generates a reproduced speech signal that is perceptually indistinguishable from the first and second segments of the speech signal. Claim 40 specifies that the coder selects a discontinuous transmission mode after the silence description coding mode. Claims 41, 42 and 43 specify that the computer network

comprises a wireless communication network, a wireless network, and a local area network, respectively. Claim 44 further specifies that the computer network further comprises a wireline communication network connected with the wireless network of claim 42.

D. Claim 46 and its dependent claims

The multi-rate codec of independent claim 46 encodes a first speech signal having a first plurality of segments and receives a second speech signal having a second plurality of encoded segments, and includes a multi-rate coder, wherein the multi-rate coder is capable of coding each of the segments of the first speech signal via one of a plurality of speech coding modes and a silence description coding mode, wherein the multi-rate coder selects the silence description mode when an absence of a substantially speech-like characteristic is detected in a segment independent of the speech coding mode applied to an immediately earlier segment, and a multi-rate decoder operatively coupled to the multi-rate coder, wherein the multi-rate decoder is capable of receiving and decoding the second plurality of encoded segments, wherein the multi-rate decoder selectively adds comfort noise to the decoded segment.

Dependent claims 47 to 53 specify various embodiments of the multi-rate codec of claim 46. Thus, claim 47 specifies that the multi-rate codec of claim 46 further comprises an error checking mechanism that reduces erroneous transmission by transmitting redundant data and performing majority voting on the redundant data. Claim 48 specifies that the multi-rate codec transmits the redundant data when the first speech signal is being coded with the silence description coding mode. Claim 49 further specifies that the amount of the redundant data transmitted in claim 48 is a function of an available communication bandwidth. Claim 50 further specifies that the multi-rate coder comprises a perceptual weighting filter. Claims 51, 52 and 53 further specify that the multi-rate coder further selects a speech coding mode from the plurality

of speech coding modes as a function of a power consumption level associated with each speech coding mode, selects a speech coding mode from the plurality of speech coding modes as a function of a electromagnetic interference level associated with each speech coding mode, and selects a speech coding mode from the plurality of speech coding modes as a function of a radio frequency interference level associated with each coding mode, respectively.

E. Claim 34 and its dependent claims

Independent method claim 34 specifies a method for encoding a speech signal and includes coding a first segment of the speech signal using a speech coding mode selected from a plurality of speech coding modes, and coding a second segment of the speech signal using a silence description coding mode independent of the speech coding mode used to code the first segment of the speech signal immediately before the second segment.

Dependent claims 35 to 37 specify various embodiments of the speech coding method of independent claim 34. Thus, claims 35 and 36 further specify transmitting the coded first and second segments of the speech signal, and transmitting an error checking signal with the coded second segment of the speech signal, respectively. Claim 37 further specifies that transmitting the error checking signal of claim 36 comprises transmitting redundant data.

ISSUES

(1) Whether the Examiner's rejection that claims 21-35 on Appeal are unpatentable under 35 U.S.C. §103 over U.S. Patent No. 6,182,032 to **Rapeli** in view of U.S. Patent No. 6,029,127 to **Delargy et al**. is erroneous.

(2) Whether the Examiner's rejection that claims 38-44 and 46 on Appeal is unpatentable under 35 U.S.C. §103 over U.S. Patent No. 6,182,032 to **Rapeli** is erroneous.

(3) Whether the Examiner's rejection that claims 36, 37, 47 and 48 on Appeal are unpatentable under 35 U.S.C. §103 over U.S. Patent No. 6,182,032 to **Rapeli** in view of U.S. Patent No. 5,436,899 to **Fujino et al.** is erroneous.

(4) Whether the Examiner's rejection that claim 49 on Appeal is unpatentable under 35 U.S.C. §103 over U.S. Patent No. 6,182,032 to **Rapeli** in view of U.S. Patent No. 5,436,899 to **Fujino et al.** and further in view of publication "Multilevel RS/Convolutional Concatenated Coded QAM for Hybrid IBOC-AM Broadcasting," IEEE Transactions on Broadcasting, pages 49-59, March 2000 by **Chung et al.** is erroneous.

(5) Whether the Examiner's rejection that claim 50 on Appeal is unpatentable under 35 U.S.C. §103 over U.S. Patent No. 6,182,032 to **Rapeli** in view of U.S. Patent No. 5,436,899 to **Fujino et al.** and further in view of publication "Multilevel RS/Convolutional Concatenated Coded QAM for Hybrid IBOC-AM Broadcasting," IEEE Transactions on Broadcasting, pages 49-59, March 2000 by **Chung et al.** and further in view of publication "Design of a Pitch Synchronous Innovation CELP Coder for Mobile Communications", IEEE Journal on Selected Areas in Communications, pages: 31-41, Jan. 1995 by **Mano et al.** is erroneous.

(6) Whether the Examiner's rejection that claim 51 on Appeal is unpatentable under 35 U.S.C. §103 over U.S. Patent No. 6,182,032 to **Rapeli** in view of publication "CDMA System Design through Asymptotic Analysis", Global Telecommunication Conference, pages 2456-2460 vol. 5, 5-9 Dec. 1999 by **Claire et al.** is erroneous.

(7) Whether the Examiner's rejection that claims 52 and 53 on Appeal are unpatentable under 35 U.S.C. §103 over U.S. Patent No. 6,182,032 to **Rapeli** in view of publication "Design

of a Pitch Synchronous Innovation CELP Coder for Mobile Communications", IEEE Journal on Selected Areas in Communications, pages: 31-41, Jan. 1995 by **Mano et al.** is erroneous.

GROUPING OF CLAIMS

Claims 21-44 and 46-53 stand or fall together, for reasons set forth in the Argument.

ARGUMENT

(1) The Rejection of Claims 21-35.

Claims 21-35 stand rejected under 35 U.S.C. § 103 as unpatentable over U.S. Patent No. 6,182,032 to **Rapeli** in view of U.S. Patent No. 6,029,127 to **Delargy et al**. The Examiner contends that **Rapeli** discloses all aspects of the claimed communication system, communication device, speech codec, and method. Referencing Fig. 2 of **Rapeli**, the Examiner states that "**Rapeli** includes a Voice Activity Detection circuit coupled to a processor for the purpose of selectively coding." The Examiner further states that "**Rapeli** describes the coding as being a plurality of coding modes for speech (column 4 line 39-48) and one for silence (as silence & pauses in column 7 line 27)." According to the Examiner, "by not specifying a dependency between processing speech and non-speech segments, **Rapeli** makes it clear to a person of ordinary skill in the art of speech signal processing that the selection of the silent mode would be made independent of any previous speech coding mode" (Final Rejection, Paper No. 10, pages 4 and 5) (emphasis added).

For the reasons that follow, it is respectfully submitted that claims 21-35 are neither disclosed nor in any manner suggested by the teachings of **Rapeli** and **Delargy et al.,** considered either singly or collectively.

Rapeli discloses a communication system having a network (element 2 in Fig. 1) and a plurality of terminals (elements 4, 5, 6 and 7 of Fig. 1). In one mode of operation, two terminals of the communication system may communicate with each other through two-way voice communication where the voice paths of the two-way voice communication are acoustically coupled to each other. In a second mode of operation, the two terminals communicate through at least one non-acoustically coupled path. For example, terminal 7 (of Fig. 2) comprises switching means (switch-over switches 34 and 35 of Fig. 2) for switching between a two-way voice communication link and a one-way voice communication link.

Multi-rate encoders and decoders assigned to the non-acoustically coupled path operate at a lower bit rate in the mode when the two terminals communicate through at least one non-acoustically coupled path than in the mode when the two terminals operate through two-way voice communication (Column 2, lines 41-52; column 5, lines 31-34 of the specification; and the Abstract).

Rapeli suggests that there is no acoustic or electronic noise or voice loop back if the B-end terminal is a non-acoustically coupled device and thus neither terminal would need a loop back for the voice signal, nor any echo canceling. Under such circumstances, a longer one-way signal delay is acceptable, and therefore coding and decoding with a lower corresponding bit rate is likewise acceptable (Column 2, lines 53-65). Thus, selection of the speech coding rate in **Rapeli** is based upon the detection of a mode of operation of the terminal (i.e., upon detection of one-way voice communication). In one embodiment described in **Rapeli,** a subscriber at

terminal 7 activates voice mail software. Upon activation of the voice mail, the terminal 7 can send a message to network 2, instructing network 2 to set its corresponding encoding and decoding means to a lower bit rate (Column 5, lines 40-45).

However, there is no disclosure or suggestion in **Rapeli** for implementing or providing silence description coding of a speech signal segment independent of the speech coding mode applied to other speech signal segments. In fact, as the Examiner correctly points out, **Rapeli** does not discuss "dependency" or "independency" at all with respect to coding speech signal segments, and is completely silent on the subject matter. Quite simply, **Rapeli** is directed to a system and method for selecting a speech coding rate based on a detected mode of operation of the terminals.

The concept disclosed in **Rapeli** is that a communication system may provide either two-way communication or one-way communication between two terminals of the system. In two-way communication mode, **Rapeli** employs conventional Comfort Noise ("CN") generation to simulate background noise, during which the speech signal from other frames are interpolated and averaged to generate CN parameters. **Rapeli** does not disclose or suggest selecting a "silence description coding mode (from a plurality of coding modes) upon the detection of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment." Thus, claims 21-35 of the present application are neither anticipated nor rendered obvious by the disclosure of **Rapeli**.

The Examiner concedes the above by relying on what is not disclosed, rather than what is disclosed, in **Rapeli**. <u>The Examiner contends that "by not specifying a dependency between processing speech and non-speech segments, **Rapeli** makes it clear to a person of ordinary skill</u>

in the art of speech signal processing that the selection of the silent mode would be made independent of any previous speech coding mode" (Final Rejection, Paper No. 10, pages 4 and 5) (emphasis added). However, the Examiner's approach is contrary to the enduring principle that the prior art must disclose or suggest the claimed invention in order to support an obviousness rejection. In **In re Gordon**, 733 F.2d 900, 902 (Fed. Cir. 1984), the Federal Circuit has set forth the obviousness determination rule (see also **In re Fitch**, 972 F.2d 1260 (Fed. Cir. 1992)):

> "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious *unless the prior art suggested the desirability of the modification*" (emphasis added).

By relying upon what **Rapeli** does not disclose (i.e., "by not specifying a dependency between processing speech and non-speech segments"), the Examiner seeks to introduce a suggestion and modification into **Rapeli** which is wholly lacking from and is unsupported by the reference itself (i.e., "that selection of the silent mode would be made independent of any previous speech coding mode"). This conclusion is clearly based on appellant's disclosure, since the reference discloses or suggests nothing in this regard. As pointed out above, **Rapeli** neither discloses nor in any was suggests selecting a "silence description coding mode (from a plurality of coding modes) upon the detection of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment" as recited in independent claim 21 and as similarly specified in independent claim 34. Such an approach only becomes evident in light of appellant's disclosure. Here, the combination of teachings proposed by the Examiner simply is not based on any evidence of reason, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to make such modifications. Rather, the reason, suggestion and motivation for the

modification proposed by the Examiner is impermissible hindsight reconstruction given the benefit of the appellant's disclosure.

The Federal Circuit has stated that even for a modification that can be characterized as "simple," the prior art must still suggest the desirability of such modification. In **In re Chu**, 66 F.3d 292, 298 (Fed. Cir. 1995), the Federal Circuit reaffirmed the rule annunciated in **In re Gordon** and provided the following guidance:

> In a proper obviousness determination, "whether the changes from the prior art are 'minor', ... the changes must be evaluated in terms of the whole invention, including whether the prior art provides any teaching or suggestion to one of ordinary skill in the art to make the changes that would produce the patentee's ... device." (citations omitted.) This includes what could be characterized as simple changes, as in *In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. (BNA) 1125, 1127 (Fed. Cir. 1984)* **(Although a prior art device could have been turned upside down, that did not make the modification obvious unless the prior art fairly suggested the desirability of turning the device upside down).** (emphasis added.)

Appellant respectfully submits that by "**not specifying dependency**", as stated by the Examiner, **Rapeli** falls far short of suggesting the desirability of selecting the silent mode independent of any previous speech coding mode. As stated above, **Rapeli** is completely silent on the entire subject matter relating to dependency or independency, and if any conclusion or suggestion is to be drawn by the Examiner from **Rapeli**, it should be that **Rapeli** operates according to other prior art in existence at the time of **Rapeli**, i.e. selection of the silent mode in **Rapeli** is dependent upon previous speech coding mode, as opposed to what has been taught by the present invention.

With respect to the detection of silence, **Rapeli** discloses a voice activity detection ("VAD") unit (element 13 in Fig. 1 and element 29 in Fig. 2). VAD unit 13 of Fig. 1 in **Rapeli** detects speech pauses. Upon the detection of a speech pause by VAD unit 13, comfort noise is generated by comfort noise unit (element 12 in Fig. 1) in a way carried out for Discontinuous Transmission ("DTX") (Column 4, lines 47-52). Comfort Noise ("CN") generation is well known in the field of DTX. However, since nothing in **Rapeli** suggests generating CN in a way contrary to the conventional wisdom in the art, it is presumed that a person of ordinary skill in the art employing the system of **Rapeli** would use conventional CN generation:

> "A person of ordinary skill in the art is also presumed to be one who thinks along the line of conventional wisdom in the art and is not one who undertakes to innovate, whether by patient, and often expensive, systematic research or by extraordinary insights, it makes no difference which." **Standard Oil Co. v. American Cyanamid Co.**, 774 F.2d 448, 454 (Fed. Cir. 1985) (emphasis added).

As pointed out in the appellant's disclosure, conventional CN generation is a specific mode of DTX wherein only a small number of speech parameters are transmitted from an encoder to a decoder in a speech codec, and intermediary values between the small number of speech parameters are generated via interpolation (Page 4, lines 14-17). Interpolation, as is known in the art of speech coding, provides a smooth change in the filter parameters between frames. Thus, filter coefficients generated for CN, for a given speech signal frame, are necessarily dependent upon the prior speech coding parameters applied to prior frames through interpolation. Moreover, the process for generating parameters used to describe CN conventionally involves the analysis and averaging of speech signals over multiple frames. For example, in Linear Prediction Coding ("LPC"), two CN parameters, the average excitation gain g_{mean} and the set of average short term spectral coefficients $f_{mean}(i)$, are based on the analysis and

averaging over several transmission frames. Thus, according to the conventional wisdom in the art, the process for generating CN parameters for a given frame is necessarily dependent upon the coding applied to speech signals in other frames.

In fact, **Rapeli**, rather than disclosing or suggesting the present invention, teaches that the coding of a speech signal frame is necessarily dependent upon the coding applied to prior and/or other speech signal frames. VAD unit 29 in Fig. 2 of **Rapeli** is used to detect well-known instantaneous active and silent pauses in DTX and/or to detect the end of a voice message (Column 7, lines 26-30). Unlike VAD unit 13, which is used to generate CN parameters, VAD unit 29 is used for switching the mode of operation of the terminal from two-way communication to one-way communication, and vice versa (Column 7, lines 17-29). Application of VAD unit 29 in accordance with **Rapeli** to switch the mode of operation of a terminal neither discloses nor in any way suggests the silence description coding mode apparatus and method as recited in independent claims 21 and 34 in the present application wherein the speech coding mode applied to a speech signal is independent of the speech coding mode immediately applied before the segment.

Thus, the communication device of independent claim 21 specifies a voice activity detection circuit and a processing circuit "wherein the processing circuit selects the silence description coding mode upon the identification of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment." Similarly, independent method claim 34 specifies "coding a second segment of the speech signal using a silence description coding mode independent of the speech coding mode used to code the first segment of the speech signal immediately before the second segment." **Rapeli** neither discloses nor in any manner suggests a coding apparatus

configured to employ such a speech coding scheme or method of coding a speech signal involving such a method step.

The Examiner cites Fig. 1 of **Delargy et al.** as purportedly teaching the coding scheme and method of appellant's invention. For the reasons that follow, the basic deficiencies of **Rapeli** are not remedied by resort to the teachings of this secondary reference.

Delargy et al. discloses an audio data compression method wherein if the audio for an analyzed time frame is silence, a single byte output is generated by the encoder. If the next frame is silence no output is generated (Column 2, lines 36-48 and the Abstract). Under this arrangement the coding applied to a subsequent audio frame is directly dependent upon the coding of the audio signal in the previous frame in complete contradiction and conflict to the approach disclosed and claimed by appellant. Thus, this reference further supports appellant's position that the conventional wisdom in the art that coding applied to an audio signal or audio segment is dependent upon coding applied to other audio signals or other audio segments.

Considered together, the collective teachings of **Rapeli** and **Delargy et al.** do not and cannot result in the present claimed invention. The purported teachings suggested by the Examiner are not based on anything that can be gleaned from the teachings of these references considered together. Rather, the teachings suggested by the Examiner are based on a classic hindsight reconstruction given the benefit of appellant's disclosure, which is impermissible. Thus, independent claim 21 and its corresponding dependent claims 22-34 and independent claim 34 and its corresponding dependent claims 35-37 of the present application are not rendered obvious by the disclosure of **Rapeli** in view of **Delargy et al**.

Accordingly, the rejection of claims 21-35 under 35 U.S.C. §103 over the combined teachings of **Rapeli** and **Delargy et al**. is improper and should be reversed.

(2) <u>The Rejection of Claims 38-44 and 46.</u>

Claims 38-44 and 46 stand rejected under 35 U.S.C. § 103 as unpatentable over U.S. Patent No. 6,182,032 to **Rapeli** for reasons similar to independent claim 21.

For the reasons that follow, it is respectfully submitted that the present claimed invention of claims 38-44 and 46 is neither disclosed nor in any manner suggested by the disclosure of **Rapeli**.

Independent claim 38 and 46 specify limitations similar to those recited in claim 21. In particular, communication system of independent claim 38 specifies a coder comprising a voice activity detector and a processor "wherein the processor applies the silence description coding mode to the second segment of the speech signal independent of the speech coding mode applied to the first segment of the speech signal immediately before the second segment." Similarly, the multi-rate codec of independent claim 46 specifies that "the multi-rate coder selects the silence description mode when an absence of a substantially speech-like characteristic is detected in a segment independent of the speech coding mode applied to an immediately earlier segment." For the reasons noted in the previous section, the disclosure of **Rapeli** does not result in the presently claimed invention.

In this regard, **Rapeli** does not disclose or in any way suggest applying or selecting a "silence description coding mode (from a plurality of coding modes) upon the detection of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment" as specified in independent claims 38 and 46. Thus, independent claim 38 and its corresponding dependent claims 39-44 and independent claim 46 and its corresponding dependent claims 47-53 of the present application are neither anticipated nor rendered obvious by the disclosure of **Rapeli**.

Accordingly, the rejection of claims 38-44 and 46 under 35 U.S.C. §103 over **Rapeli** is improper and should be reversed.

(3) The Rejection of Claims 36, 37, 47 and 48.

Claims 36, 37, 47 and 48 stand rejected under 35 U.S.C. § 103 as unpatentable over U.S. Patent No. 6,182,032 to **Rapeli** in view of U.S. Patent No. 5,436,899 to **Fujino et al.** The Examiner takes the position that it would have been obvious to a person of ordinary skill in the art of speech signal processing that means for detecting and remedying errors is essential to competent speech signal transmission. The Examiner bases this conclusion on the assertion that **Fujino et al.** adopt a redundancy detecting function of voice transmission as a requisite function in the statistical multiplexing method of **Fujino et al.** (Final Rejection, Paper No. 10, pages 8 and 9).

For the reasons that follow, it is respectfully submitted that the present claimed invention of claims 36, 37, 47 and 48 is neither disclosed nor in any manner suggested by the collective teachings of **Rapeli** and **Fujino et al.**

Claims 36, 37, 47 and 48 depend, either directly or indirectly, from one or the other of independent claims 34 and 46. For reasons noted in the two previous sections, the disclosure of **Rapeli** does not result in the present claimed invention. Nor does **Fujino et al.** cure the basic deficiencies of this reference. Accordingly, for the same reasons set forth in the two previous sections, claims 36, 37, 47 and 48 are not obvious based on the collective teachings of **Rapeli** and **Fujino et al.**

In this regard, **Fujino et al.** disclose a multiplexed transmission system for coding voice input information by separating it into a core information part and a supplementary information

part. **Fujino et al.** do not disclose or in any way suggest applying or selecting a "silence description coding mode (from a plurality of coding modes) upon the detection of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment." The Examiner concedes as much, since **Fujino et al.** is merely cited for its disclosure of a redundancy detecting function. However, the fact that **Fujino et al.** disclose a redundancy detecting function does not cure the basic shortcomings of the combination of references proposed by the Examiner.

Accordingly, the rejection of claims 36, 37, 47 and 48 under 35 U.S.C. §103 over the combined teachings of **Rapeli** and **Fujino et al.** is improper and should be reversed.

(4) The Rejection of Claim 49.

Claim 49 stands rejected under 35 U.S.C. § 103 as unpatentable over U.S. Patent No. 6,182,032 to **Rapeli** in view of U.S. Patent No. 5,436,899 to **Fujino et al.** and further in view of publication "Multilevel RS/Convolutional Concatenated Coded QAM for Hybrid IBOC-AM Broadcasting," IEEE Transactions on Broadcasting, pages 49-59, March 2000 by **Chung et al.** The Examiner takes the position that it would have been obvious to a person of ordinary skill in the art of speech signal processing to adjust the redundant data so as to avoid congestions and bottlenecks when remaining bandwidth would be insufficient to maintain a signal with numerous correction data. The Examiner bases this conclusion on the assertion that **Chung et al.** acknowledges the relationship between power and bandwidth limits on providing sufficient redundancy (Final Rejection, Paper No. 10, page 12).

For the reasons that follow, it is respectfully submitted that the present claimed invention of claim 49 is neither disclosed nor in any manner suggested by the collective teachings of **Rapeli, Fujino et al.** and **Chung et al.**

Claims 49 depends indirectly from independent claim 46. For reasons noted in the previous sections, the collective teachings of **Rapeli** and **Fujino et al.** do not result in the present claimed invention. Nor does **Chung et al.** cure the basic deficiencies of these references. Accordingly, for the same reasons set forth in the previous sections, claim 49 is not obvious based on the collective teachings of **Rapeli, Fujino et al.** and **Chung et al.**

In this regard, **Chung et al.** do not disclose or in any way suggest applying or selecting a "silence description coding mode (from a plurality of coding modes) upon the detection of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment." The Examiner concedes as much, since **Chung et al.** is merely cited for its acknowledgement of the relationship between power and bandwidth limits on providing sufficient redundancy. However, the fact that **Chung et al.** acknowledge the relationship between power and bandwidth limits does not cure the basic shortcomings of the combination of references proposed by the Examiner.

Accordingly, the rejection of claim 49 under 35 U.S.C. §103 over the combined teachings of **Rapeli, Fujino et al.** and **Chung et al.** is improper and should be reversed.

(5) <u>The Rejection of Claim 50.</u>

Claim 50 stands rejected under 35 U.S.C. § 103 as unpatentable over U.S. Patent No. 6,182,032 to **Rapeli** in view of U.S. Patent No. 5,436,899 to **Fujino et al.** and further in view of publication "Multilevel RS/Convolutional Concatenated Coded QAM for Hybrid IBOC-AM

Broadcasting," IEEE Transactions on Broadcasting, pages 49-59, March 2000 by **Chung et al.** and further in view of publication "Design of a Pitch Synchronous Innovation CELP Coder for Mobile Communications", IEEE Journal on Selected Areas in Communications, pages: 31-41, Jan. 1995 by **Mano et al**. The Examiner takes the position that it would have been obvious to a person of ordinary skill in the art of speech signal processing to employ perceptual weighting filters to limit the extreme transients introduced by signal reconstruction to an acceptable audio level. The Examiner bases this conclusion on the assertion that **Mano et al**. disclose perceptual weighting filters, and that perceptual weighting filters are germane to the problem of maintaining good signal quality (Final Rejection, Paper No. 10, pages 12 and 13).

For the reasons that follow, it is respectfully submitted that the present claimed invention of claim 50 is neither disclosed nor in any manner suggested by the collective teachings of **Rapeli, Fujino et al., Chung et al** and **Mano et al.**

Claims 50 depends indirectly from independent claim 46. For reasons noted in the previous sections, the collective teachings of **Rapeli, Fujino et al.** and **Chung et al.** do not result in the present claimed invention. Nor does **Mano et al**. cure the basic deficiencies of these references. Accordingly, for the same reasons set forth in the previous sections, claim 50 is not obvious based on the collective teachings of **Rapeli, Fujino et al., Chung et al** and **Mano et al.**

In this regard, **Mano et al.** do not disclose or in any way suggest applying or selecting a "silence description coding mode (from a plurality of coding modes) upon the detection of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment." The Examiner concedes as much, since **Mano et al**. is merely cited for its disclosure of perceptual weighting

filters. However, the fact that **Chung et al.** disclose perceptual weighting filters does not cure the basic shortcomings of the combination of references proposed by the Examiner.

Accordingly, the rejection of claim 50 under 35 U.S.C. §103 over the combined teachings of **Rapeli, Fujino et al., Chung et al** and **Mano et al.** is improper and should be reversed.

(6) <u>**The Rejection of Claim 51.**</u>

Claim 51 stands rejected under 35 U.S.C. § 103 as unpatentable over U.S. Patent No. 6,182,032 to **Rapeli** in view of publication "CDMA System Design through Asymptotic Analysis", Global Telecommunication Conference, pages 2456-2460 vol. 5, 5-9, Dec. 1999 by **Claire et al**. The Examiner takes the position that it would have been obvious to a person of ordinary skill in the art of speech signal processing to conserve power when necessary and to anticipate problems rather than force a loss of transmission altogether. The Examiner bases this conclusion on the assertion that **Claire et al**. examine power considerations in relation to signal quality (Final Rejection, Paper No. 10, page 13).

For the reasons that follow, it is respectfully submitted that the present claimed invention of claim 51 is neither disclosed nor in any manner suggested by the collective teachings of **Rapeli** and **Claire et al**.

Claim 51 depends directly from independent claim 46. For reasons noted in the previous sections, the disclosure of **Rapeli** does not result in the present claimed invention. Nor does **Claire et al**. cure the basic deficiencies of this reference. Accordingly, for the same reasons set forth in the previous sections, claim 51 is not obvious based on the collective teachings of **Rapeli** and **Claire et al.**

In this regard, **Claire et al.** do not disclose or in any way suggest applying or selecting a "silence description coding mode (from a plurality of coding modes) upon the detection of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment." The Examiner concedes as much, since **Claire et al.** is merely cited for its examination of power considerations in relation to signal quality. However, the fact that **Claire et al.** examine power considerations in relation to signal quality does not cure the basic shortcomings of the combination of references proposed by the Examiner.

Accordingly, the rejection of claim 51 under 35 U.S.C. §103 over the combined teachings of **Rapeli** and **Claire et al.** is improper and should be reversed.

(7) <u>**The Rejection of Claims 52 and 53.**</u>

Claims 52 and 53 stand rejected under 35 U.S.C. § 103 as unpatentable over U.S. Patent No. 6,182,032 to **Rapeli** in view of publication "Design of a Pitch Synchronous Innovation CELP Coder for Mobile Communications", IEEE Journal on Selected Areas in Communications, pages: 31-41, Jan. 1995 by **Mano et al.** The Examiner takes the position that it would have been obvious to a person of ordinary skill in the art of speech signal processing that electromagnetic or radio frequency interference would degrade the source signal enough to switch to a higher coding mode, and consequently that early detection and change would anticipate the event and reduce the data lost from a signal degraded enough to cause the transition. The Examiner bases this conclusion on the assertion that **Mano et al.** discloses that periodic background noise would be an indication that a change in coding is needed to avoid poor signal (Final Rejection, Paper No. 10, page 14).

For the reasons that follow, it is respectfully submitted that the present claimed invention of claims 52 and 53 is neither disclosed nor in any manner suggested by the collective teachings of **Rapeli** and **Mano et al.**

Claims 52 and 53 depend directly from independent claim 46. For reasons noted in the previous sections, the disclosure of **Rapeli** does not result in the present claimed invention. Nor does **Mano et al.** cure the basic deficiencies of this reference. Accordingly, for the same reasons set forth in the previous sections, claims 52 and 53 are not obvious based on the collective teachings of **Rapeli** and **Mano et al.**

In this regard, **Mano et al.** do not disclose or in any way suggest applying or selecting a "silence description coding mode (from a plurality of coding modes) upon the detection of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment." The Examiner concedes as much, since **Mano et al.** is merely cited for its reference to nonperiodic background noise. However, the fact that **Mano et al.** allude to nonperiodic background noise does not cure the basic shortcomings of the combination of references proposed by the Examiner.

Accordingly, the rejection of claims 52 and 53 under 35 U.S.C. §103 over the combined teachings of **Rapeli** and **Mano et al.** is improper and should be reversed.

CONCLUSION

The cited references of record, considered singly or collectively, fail to disclose or in any way suggest appellant's claimed invention. Accordingly, appealed claims 21-44 and 46-53 should be allowed.

This Appeal Brief is submitted herewith in triplicate along with an Appendix of the appealed claim and the requisite fee for filing the Appeal Brief.

Respectfully Submitted;
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APPENDIX OF CLAIMS ON APPEAL

21. A communication device having a multi-rate speech coder that performs silence description coding of a speech signal having varying characteristics, comprising:

a voice activity detection circuit that is capable of identifying a substantially speech-like characteristic of a segment of the speech signal; and

a processing circuit communicatively coupled to the voice activity detection circuit, the processing circuit being capable of selectively applying one of a plurality of coding modes to the segment of the speech signal,

wherein the plurality of coding modes comprises a plurality of speech coding modes and a silence description coding mode,

wherein the processing circuit selects the silence description coding mode upon the identification of the absence of a substantially speech-like characteristic of the segment of the speech signal independent of the speech coding mode applied immediately before the segment.

22. The communication device of claim 21, wherein the communication device comprises a wireless communication device.

23. The communication device of claim 22, wherein the wireless communication device comprises a telephone.

24. The communication device of claim 23, wherein the telephone comprises a cellular telephone.

25. The communication device of claim 21, wherein the communication device comprises a handheld wireless communication device.

26. The communication device of claim 21, wherein the communication device comprises a network communication device.

27. The communication device of claim 26, wherein the network communication device is capable of communicating via a network.

28. The communication device of claim 26, wherein the network communication device is capable of transmitting an encoded speech signal via a network.

29. The communication device of claim 21, wherein the communication device is capable of communicating via a wireless network.

30. The communication device of claim 29, wherein the wireless network includes a communication cell.

31. The communication device of claim 21, wherein the communication device comprises a data processor.

32. The communication device of claim 21, wherein the communication device comprises a network interface device that is capable of interfacing a wireless network.

33. The communication device of claim 21, wherein the processing circuit selects a discontinuous transmission mode after the silence description coding mode.

34. A method of coding a speech signal, comprising:

coding a first segment of the speech signal using a speech coding mode selected from a plurality of speech coding modes; and

coding a second segment of the speech signal using a silence description coding mode independent of the speech coding mode used to code the first segment of the speech signal immediately before the second segment.

35. The method of claim 34, further comprising:

transmitting the coded first and second segments of the speech signal.

36. The method of claim 35, further comprising:

transmitting an error checking signal with the coded second segment of the speech signal.

37. The method of claim 36, wherein the transmitting the error checking signal comprises transmitting redundant data.

38. A communication system, comprising:

a coder;

a decoder; and

a communication network selectively interconnecting the coder and the decoder;

wherein the coder comprises a voice activity detector, a processor coupled with the voice activity detector, and a transmitter coupled with the processor,

wherein the voice activity detector receives first and second segments of a speech signal and identifies a substantially speech-like characteristic of the first segment and an absence of a substantially speech-like characteristic of the second segment of the speech signal,

wherein the processor selectively applies one of a plurality of coding modes to the first and second segments, the plurality of coding modes comprises a plurality of speech coding modes and a silence coding mode,

wherein the processor applies the silence description coding mode to the second segment of the speech signal independent of the speech coding mode applied to the first segment of the speech signal immediately before the second segment.

39. The communication system of claim 38, wherein the decoder generates a reproduced speech signal that is perceptually indistinguishable from the first and second segments of the speech signal.

40. The communication system of claim 39, wherein the coder selects a discontinuous transmission mode after the silence description coding mode.

41. The communication system of claim 39, wherein the communication network comprises a wireless communication network.

42. The communication system of claim 39, wherein the communication network comprises a wireless network.

43. The communication system of claim 42, wherein the computer network comprises a local area network.

44. The communication system of claim 42, wherein the communication network further comprises a wireline communication network connected with the wireless network.

46. A multi-rate codec that encodes a first speech signal having a first plurality of segments and receives a second speech signal having a second plurality of encoded segments, comprising:

a multi-rate coder, wherein the multi-rate coder is capable of coding each of the segments of the first speech signal via one of a plurality of speech coding modes and a silence description coding mode, wherein the multi-rate coder selects the silence description mode when an absence of a substantially speech-like characteristic is detected in a segment independent of the speech coding mode applied to an immediately earlier segment; and

a multi-rate decoder operatively coupled to the multi-rate coder, wherein the multi-rate decoder is capable of receiving and decoding the second plurality of encoded segments, wherein the multi-rate decoder selectively adds comfort noise to the decoded segment.

47. The multi-rate codec of claim 46, further comprising an error checking mechanism that reduces erroneous transmission by transmitting redundant data and performing majority voting on the redundant data.

48. The multi-rate codec of claim 47, wherein the multi-rate codec transmits the redundant data when the first speech signal is being coded with the silence description coding mode.

49. The multi-rate codec of claim 48, wherein the amount of the redundant data transmitted is a function of an available communication bandwidth.

50. The multi-rate codec of claim 49, wherein the multi-rate coder comprises a perceptual weighting filter.

51. The multi-rate codec of claim 46, wherein the multi-rate coder selects a speech coding mode from the plurality of speech coding modes as a function of a power consumption level associated with each speech coding mode.

52. The multi-rate codec of claim 46, wherein the multi-rate coder selects a speech coding mode from the plurality of speech coding modes as a function of a electromagnetic interference level associated with each speech coding mode.

53. The multi-rate codec of claim 46, wherein the multi-rate coder selects a speech coding mode from the plurality of speech coding modes as a function of a radio frequency interference level associated with each coding mode.